

Claims

What is claimed is:

1. An apparatus to install a casing string into a borehole while it is being drilled, the casing having an internal diameter and an external diameter, the apparatus comprising:
a casing latch installed at a distal end of the casing string, the casing latch having a pass-through diameter smaller than the casing internal diameter, the casing latch configured to releaseably connect to a flexible drill collar assembly;
the flexible drill collar assembly having an enlargement tool and an articulated joint, the articulated joint adapted to position the enlargement tool in a first position that is in axial alignment with the axis of rotation of the casing string and a second position that is eccentric with respect to the axis of rotation of the casing string; and
a drill bit coupled to the enlargement tool such that when the enlargement tool is in its second, eccentric, position, the drill bit drills a borehole large enough to provide clearance for the casing string and when the drill bit is in its first, axial, position, the drill bit is removable through the casing string.
2. The apparatus of claim 1, wherein the articulated joint is lockable.
3. The apparatus of claim 2, wherein the articulated joint is locked in position by sliding cams, eccentric tracks with cam followers, or j-slot mechanisms.

4. The apparatus of claim 1, wherein the articulated joint is positioned by fluid flow or weight actuation.
5. A method of casing while drilling without the use of an underreamer, the method comprising:
 - providing a flexible drill collar assembly coupled to the casing string and having an enlargement tool affixed to a drill bit and positionable axially and eccentrically with respect to the axis of rotation of the casing string; and
 - positioning the enlargement tool eccentrically such that the affixed drill bit drills a borehole large enough for passage of the casing string therethrough.
6. The method of claim 5, further comprising:
 - retrieving the flexible collar assembly through the casing string by positioning the enlargement tool axially and removing therethrough the casing string.
7. An apparatus to install a casing string into a borehole while it is being drilled, the casing having an internal diameter and an external diameter, the apparatus comprising:
 - a casing latch installed at a distal end of the casing string, the casing latch having a pass-through diameter smaller than the casing internal diameter, the casing latch configured to releaseably connect to a vertical drilling assembly;
 - the vertical drilling assembly including a mud motor, a first cutter device, and a second cutter device, the mud motor configured to rotate the first cutter device in a direction opposite any rotation of the casing string, the second cutter device configured to rotate with the rotation of the casing string, the

vertical drilling assembly configured to be retrieved through the pass-through diameter of the casing latch.

8. The apparatus of claim 7 wherein the second cutter device is configured to drill the borehole at a gauge diameter; wherein the gauge diameter is larger than an outer diameter of the casing string.
9. The apparatus of claim 7 wherein the second cutter device is an underreamer.
10. The apparatus of claim 9 wherein the underreamer is a collapsible.
11. The apparatus of claim 7 wherein the mud motor is a positive displacement mud motor.
12. The apparatus of claim 7 wherein the mud motor is a turbine-driven mud motor.
13. The apparatus of claim 7 wherein the vertical drilling assembly further includes directional measurement equipment.
14. the apparatus of claim 7 wherein the directional measurement equipment includes a measurement while drilling tool.
15. The apparatus of claim 13 wherein the directional measurement equipment includes a gyroscope.
16. The apparatus of claim 13 wherein the directional measurement equipment includes accelerometers.

17. The apparatus of claim 13 wherein the directional measurements equipment includes a gravity pendulum.
18. The apparatus of claim 13 wherein the vertical drilling assembly includes at least one kick pad to correct any deviations in the borehole detected by the directional measurement equipment.
19. The apparatus of claim 7 wherein the first cutter device is a standard drill bit located on a central axis of the vertical drilling assembly.
20. The apparatus of claim 19 wherein the second cutter device is a located on a peripheral surface of the vertical drilling assembly.
21. An apparatus to install a casing string into a borehole while it is being drilled, the casing having an internal diameter and an external diameter, the apparatus comprising:
 - a casing latch installed at a distal end of the casing string, the casing latch having a pass-through diameter smaller than the casing internal diameter, the casing latch configured to releaseably connect to a vertical drilling assembly;
 - the vertical drilling assembly including directional measurement equipment and at least one actuator, the directional measurement equipment configured to determine any deviations of the borehole from true vertical, the actuator configured to directionally bias the vertical drilling assembly in response to reports from the directional measurement equipment, the vertical drilling

assembly configured to be retrieved through the pass-through diameter of the casing latch.

22. The apparatus of claim 21 wherein the directional measurement equipment includes a gyroscope.

23. The apparatus of claim 21 wherein the directional measurement equipment includes accelerometers.

24. The apparatus of claim 21 wherein the directional measurements equipment includes a gravity pendulum.